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#### **(54) Gelling material and gelling method.**

(57) The invention concerns a gelling material for gelling aqueous fluids, medical wastes containing aqueous fluids, body fluids collected by suction in body fluid suction equipment. The gelling material comprises a water-absorbent composed of a water-absorbing resin in the form of powders or granules, the water-absorbent being wrapped in water-disintegrating paper or a water-soluble film or a laminate sheet obtained by laminating water-disintegrating paper and a water-soluble film. The invention also

concerns a method of gelling aqueous fluid and medical waste by adding the gelling material to the aqueous fluid or medical waste. The aqueous fluid or medical waste can be gelled conveniently and in a short period of time. The gel thus produced never releases absorbed fluid even when an external pressure is applied to it.

Thus, the invention is useful for the treatment of aqueous fluids such as sludge-like wastes produced in plants and also of medical wastes and body fluids.

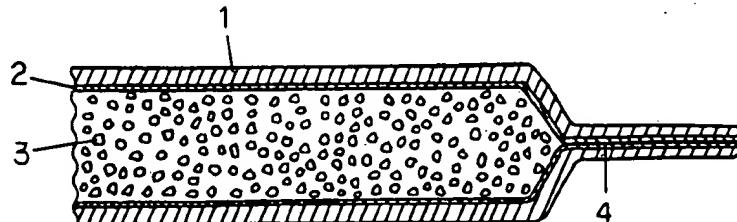


Fig. 1

## FIELD OF THE INVENTION

The present invention relates to gelling materials and gelling method useful for gelling aqueous fluids, medical wastes and body fluids collected by body fluid suction equipment. More specifically, the invention concerns gelling materials and gelling method for gelling various kind of aqueous fluids; body fluids such as blood and amniotic fluid, produced during operation in hospitals and parturition in maternity hospitals, medical wastes contaminated by body fluids, such as absorbent cotton, gauze, injection needles and operation gloves; and body fluids collected by body fluid suction equipment such as blood and amniotic fluid produced during operation and parturition.

## BACKGROUND OF THE INVENTION

Well-known gelling materials for gelling aqueous fluids include such absorbents as sand, bentonite, zeolite, sawdust, pulp, paper waste and water-absorbent resins.

Also, in many cases medical wastes produced in hospitals and maternity hospitals are collected in plastic or like containers for incineration therewith. Further, in many cases, body fluids collected by body fluid suction equipment in hospitals and maternity hospitals, are also incinerated together with their containers.

The above water-absorbents, however, have the following problems. (1) They are usually added in the form of powders or fine flakes, and at this time they may be spilled or produce dust. (2) Since they are in the form of powders or fine flakes, they require a lot of time for addition. (3) Their absorbing capacity is low, and therefore they have to be added in great quantities. (4) When pressure is applied to them after the absorption, they readily discharge the absorbed fluid to contaminate the surroundings.

Further, in the case of incinerating body fluids and other medical wastes directly without solidifying them, their containers may be occasionally broken during transportation to the incineration site, causing the wastes to flow out and soak into the ground. In such case, it is difficult to recover them, thus resulting in hazardous contamination of the ground.

## SUMMARY OF THE INVENTION

It is an object of the invention to provide a gelling material and a gelling method, which permit ready handling without possibility of spilling or dusting and do not require conventional measuring or sprinkling time when adding the gelling material to aqueous fluids, medical wastes or body fluids in

body fluid suction equipment.

It is another object of the invention to provide a gelling material and a gelling method, which provide for high absorbing capacity, permit addition in small quantities, and ensure retention of fluid once absorbed even with application of external pressure to the gelling material after the absorption.

It is a further object of the invention to provide a gelling material and a gelling method for medical wastes, which permit safe handling of medical wastes.

It is a still further object of the invention to provide a gelling material and a gelling method for body fluids collected by body fluid suction equipment, which permit safe handling of body fluids recovered in containers in the body fluid suction equipment.

In order to accomplish the above objects, the invention relates to a gelling material for gelling aqueous fluids comprising a water-absorbent which is wrapped in water-disintegrating paper or a water-soluble film or a laminated sheet which comprises water-disintegrating paper and water-soluble film, wherein said water-absorbent comprises a water-absorbing resin in the form of powders or granules.

Preferably, the gelling material according to the invention uses a filler together with the water-absorbing resin.

In its process aspects, the present invention relates to a method of gelling an aqueous fluid comprising adding an aqueous fluid gelling material to aqueous fluid, wherein said aqueous fluid gelling material comprises a water-absorbent which is wrapped in water-disintegrating paper or a water-soluble film or a laminated sheet which comprises water-disintegrating paper and water-soluble film, and said water-absorbent comprises a water-absorbing resin in the form of powders or granules.

Preferably, the gelling material used for the above method of gelling aqueous fluids according to the invention uses a filler together with the water-absorbing resin.

Further, the present invention relates to a gelling material for gelling medical wastes comprising a water-absorbent which is wrapped in water-disintegrating paper or a water-soluble film or a laminated sheet which comprises water-disintegrating paper and water-soluble film, wherein said water-absorbent comprises a water-absorbing resin in the form of powders or granules.

Preferably, the gelling material for medical wastes according to the invention uses a filler together with the water-absorbing resin.

In its process aspects, the present invention further provides a method of gelling medical wastes comprising adding a medical waste gelling material to a medical waste containing aqueous fluids, wherein said medical waste gelling material

comprises a water-absorbent which is wrapped in water-disintegrating paper or a water-soluble film or a laminated sheet which comprises water-disintegrating paper and water-soluble film, and said water-absorbent comprises a water-absorbing resin in the form of powders or granules.

Preferably, the gelling material used for the above method of gelling medical wastes according to the invention uses a filler together with the water-absorbing resin.

According to the invention, there is further provided a gelling material for body fluids collected by body fluid suction equipment, comprising a water-absorbent which is wrapped in water-disintegrating paper or a water-soluble film or a laminated sheet which comprises water-disintegrating paper and water-soluble film, wherein said water-absorbent comprises a water-absorbing resin in the form of powders or granules.

In its process aspects, the invention relates to a method of gelling fluid which flow into a disposable waste container set in a canister fixing container of body fluid suction equipment, which comprises adding a body fluid suction equipment gelling material to said fluid, wherein said body fluid suction equipment gelling material comprises a water-absorbent which is wrapped in water-disintegrating paper or a water-soluble film or a laminated sheet which comprises water-disintegrating paper and water-soluble film, and said water-absorbent comprises a water-absorbing resin in the form of powders or granules.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a partially schematic sectional view showing a gelling material in one of the preferred embodiments of the invention; and

Figure 2 is a schematic sectional view showing a body fluid suction equipment including the gelling material in one embodiment of the invention.

#### DETAILED DESCRIPTION OF THE INVENTION

According to the invention, as the water-absorbing resin there may be used ① those, which are obtainable by polymerizing (a) starch or cellulose, (b) a monomer containing a carboxyl group and/or a sulfonic acid group, the monomer being water-soluble or capable of being rendered water-soluble by hydrolysis, and (c) a crosslinking agent, as essential components, and carrying out hydrolysis, if necessary.

The details of the materials (a) to (c) used for the manufacture of the examples ① of the water-absorbing resin, proportions of the materials (a) to (c), method of manufacture and examples of the

water-absorbing resin, are well known and disclosed in, for instance, Japanese published Patent Application (Kokai) No. 25886/1977, Japanese patent publication (Kokoku) No. 46199/1978, Japanese patent publication (Kokoku) No. 46200/1978 and Japanese patent publication (Kokoku) No. 21041/1980.

Other examples of the water-absorbing resin than those mentioned above are ② those obtainable by polymerizing the materials (a) and (b) (e.g., hydrolyzed starch-acrylonitrile graft-copolymer and hydrolyzed cellulose-acrylonitrile graft-copolymer); ③ those obtainable by crosslinking material (a) (e.g., crosslinked carboxymethyl cellulose); ④ copolymers of materials (b) and (c) (e.g., partially hydrolyzed crosslinked polyacrylamide, crosslinked acrylic acid-acrylamide copolymer, crosslinked sulfonated polystyrene, saponified vinyl ester-unsaturated carboxylic acid copolymer as disclosed in Japanese Published Patent Application (Kokai) No. 14689/1977 and Japanese Published Patent Application (Kokai) No. 27455/1977, crosslinked polyacrylic acid salt, crosslinked acrylic acid-acrylic acid ester copolymer, crosslinked isobutylene-maleic acid anhydride copolymer and crosslinked carboxylic acid denatured polyvinyl alcohol; and ⑤ self-crosslinkable polymers of material (b) (e.g., self-crosslinkable polyacrylic acid salt). It is possible to use two or more kinds of the water-absorbing resin as disclosed above in combination.

Among the above examples of the water-absorbing resin, ① and some of ④ such as partially hydrolyzed crosslinked polyacrylamide, crosslinked acrylic acid-acrylic acid ester copolymer, crosslinked isobutylene-maleic acid anhydride copolymer, and crosslinked carboxylic acid denatured polyvinyl alcohol are preferable.

The suitable water-absorbing resins in the above are those having an absorbing capacity with respect to pure water of at least 50 ml/g, preferably 100 to 1,000 ml/g. The resin is suitably in the form of powders or granules (with the particle size being usually within 5 mm).

If desired, other absorbents may be used in combination with the above mentioned water-absorbing resin (e.g., pulp and sawdust as well-known absorbents). However, the greater the proportion of the above mentioned water-absorbing resin, the more suitable.

According to the invention, a filler may be used together with the absorbent. Examples of the filler are such inorganic fillers as activated clay, zeolite, talc, diatomaceous earth, bentonite, caryon, clay, silica gel, sand, pumice and gypsum and such organic fillers as sawdust, pulp, paper pieces and resin chips, these fillers being in the form of particles, flakes, fibers, etc. By using these fillers together with the water-absorbing resin, it is possi-

ble to prevent agglomeration of the absorbent resin particles that might otherwise be caused when the absorbent is brought into contact with a body fluid or other aqueous fluid.

The amount of the filler to be used together with the absorbent according to the invention is usually 0.001 to 100 parts by weight, preferably 0.005 to 20 parts by weight, for one part by weight of the absorbent.

To the absorbent and/or filler according to the invention may be added deodorant, aromatic agent, bactericide, anti-rusting agent, antiseptics, anti-foaming agent, foaming agent, agglomerating agent, anti-blocking agent, surface active agent, deoxidation agent, extending agent, etc.

Examples of the water-disintegrating paper used as wrapping material according to the invention, are one which is obtained by bonding together paper pulp fibers with water-soluble or hydrophilic adhesive, water-swelling polymer, etc. such that the pulp fibers disintegrate when brought into contact with water (an example of such kind of paper is "Dissolvo WA" by Mishima Paper Mfg. Co., Ltd.), and one which is obtained by applying a heat seal agent to the above paper composition for providing forming processability (thermal bonding property) (an example of such kind of paper is "Dissolvo WAP" by Mishima Paper Mfg. Co., Ltd.). These examples of paper feature a high rate of disintegration when they absorb water.

Examples of the water-soluble film are water-soluble polyvinyl alcohol (poval) film, starch film, and carrageenan film. These films have higher tensile strength in dry state than that of the water-disintegrating paper noted above at the same thickness, although they are somewhat inferior in the speed of dissolution in water (i.e., disintegration).

As the laminated sheet obtainable by laminating the water-disintegrating paper and the water-soluble film, there may be used one which is obtained by bonding or laminating at least one kind of the water-disintegrating paper and the water-soluble film (e.g., "Dissolvo WAL" by Mishima Paper Mfg. Co., Ltd., obtained by laminating the poval film to "Dissolvo WA" noted above).

These laminated sheets are quickly degraded in water (i.e., quickly disintegrated) and also have high mechanical strength. Since the mechanical strength of paper is high, the thickness of the water-soluble film to be laminated can be reduced. Thus, both the degradation (or disintegration) speed and mechanical strength of the sheet can be increased.

Among the above wrapping materials, the water-disintegrating paper and laminated sheet are preferable, particularly the laminated sheet. The time required for the disintegration or dissolution of the wrapping material in water is usually 5 minutes

or less, preferably 2 minutes or less, more preferably 1 minute or less.

According to the invention, the aqueous fluid may be any water-containing fluid and may contain such solids as sand, clay, gravel, inorganic oxides, hydroxides, rubber, plastic pieces, glass pieces, wood dust, fiber dust, carbon, carbohydrates, protein, solid fat, microorganisms, meat pieces and carcasses and liquids other than water, e.g., organic solvents, fatty oil, mineral oil, petroleum and active agents.

The water content in the fluid is usually 50 % or above. Examples of the aqueous fluid are sludge-like wastes produced in mining sites, civil and construction work sites, paper pulp manufacturing plants, fiber manufacturing and dying plants, machine and metal processing plants, mineral refining plants, chemical plants, electric and electronic product plants, medical industry facilities such as hospitals, food processing plants, ceramic product plants, water purification plants, sewage plants as well as homes.

Examples of the medical waste according to the invention are body fluids such as blood, lymph fluid, medullary fluid and amniotic fluid, and medical tools and consumables contaminated by these fluids, e.g., absorbent cotton, injection needles, operation gloves and disposable sheets. These medical wastes are produced during surgery in hospitals and parturition in maternity hospitals and may contain portions of removed body tissues, physiological salt solution having been used for washing of affected parts, water and antiseptic solution having been used for washing operation tools and tables, medicines, used ampules, dust, etc.

When the medical waste mainly consists of medical tools and consumables contaminated by the body fluids and contains little water, water may be added to it for effectively using the gelling material and gelling method according to the invention. With the method according to the invention, the medical waste which includes medical tools and consumables as noted above, may be converted into an integrated gel which may be readily and conveniently handled for disposal and also can prevent pollution and contamination of the surroundings.

According to the invention, the body fluids collected in the body fluid suction equipment refer to fluids in the living body as noted above and specifically blood, lymph liquid, medullary fluid, amniotic fluid, etc. These body fluids are produced during operation in hospitals and parturition in maternity hospitals. They may contain removed organism tissues, physiological salt solution having been used for washing of affected parts, water having been used for washing operation tools and tables, dust, etc.

The gelling material according to the invention may be manufactured by preliminarily producing a wrapping member having an opening having predetermined shape and size with any one of the wrapping materials noted above, then filling the wrapping member with a predetermined amount of the absorbent and a filler, if necessary, and then sealing the wrapping member by means of a heat seal, an adhesive, sewing, etc.

The gelling material for aqueous fluids according to the invention may have any shape such as bag-like, box-like, cylindrical, ball-like and spherical. It may also have any size. The gelling material for aqueous fluids may be used in amounts depending on the proportions of the water-absorbing resin and filler and also the character of the aqueous fluid to be processed. Usually, about one liter of ordinary aqueous fluid may be sufficiently gelled with 1 to 600 g of the gelling material according to the invention. If the amount of the gelling material is less than 1 g, the aqueous fluid can not be sufficiently gelled. An amount greater than 600 g, on the other hand, is uneconomical.

The aqueous fluid may be gelled in a short period of time (usually about one minute) by adding the gelling material according to the invention and suitably agitating the overall fluid. The agitation is carried out sufficiently to effect light mixing of the overall fluid. It may be done using a general-purpose agitator, which is not particularly limited. Manual agitation using a spatula is sufficient.

If solid articles such as injection needles are partly projecting from the fluid surface of medical waste or the like to be gelled, water may be added to the medical waste in the container before adding the gelling material according to the invention. In this way, the whole solid matter may be concealed with the gel.

Meanwhile, the gelling material according to the invention may be put into the container before medical waste such as body fluid is charged or flows into the container.

The invention will now be described with reference to the drawings. Figure 1 is a partially schematic sectional view showing one preferred embodiment of the gelling material according to the invention. Designated at 1 is water-disintegrating paper, at 2 is water-soluble polyvinyl alcohol (poval) film bonded to the paper 1, at 3 is water-absorbing resin in the form of particles, and at 4 is a heat seal section. Although Figure 1 shows the gelling material in a partly broken-away view, the wrapping member is bag-like as a whole. The heat seal section is formed by heat sealing an opening, and it may be formed in at least one or all of the four sides, so long as the content is sealed in the wrapping member. Usually a heat seal agent is coated on the heat seal section.

Figure 2 is a schematic sectional view showing body fluid section equipment accommodating the gelling material according to the invention. Designated at 5 is a canister securement container, at 6 is a disposable container, at 7 is a body fluid inlet, at 8 is a body fluid outlet, at 9 is a gelling material inlet, and at 10 is a gelling material according to the invention. In this equipment, the gelling material 10 is preferably cylindrical, since this shape is convenient for charging the gelling material into the container. However, this shape is by no means limitative.

The body fluid gelling material for body fluid section equipment according to the invention may have a shape and a size such that it can be charged into the container used in the method according to the invention. As noted before, its shape may be bag-like, box-like, cylindrical, ball-like, spherical or any other shape. The amount of the water-absorbent for body fluid according to the invention depends on the character of the body fluid to be processed, but about 2 kg of body fluid, mainly comprising blood collected particularly during operation, may be sufficiently gelled with 5 to 100 g of the gelling material according to the invention.

According to the invention, the canister securement container 5 is usually made of plastics or metals, and its shape is usually cylindrical. It may have a structure that the disposable container 6 capable of accommodating body fluid withdrawn thereinto can be set in it. The disposable container 6 is not particularly limited so long as it can be set in the canister securement container and can hold the withdrawn body fluid. Usually, foldable bag-like disposable containers made of polyvinyl chloride, polyethylene, polypropylene, etc. are suitable for they are inexpensive and capable of ready handling.

The body fluid sucked into the disposable container may be gelled in a short period of time (usually about one minute) by adding the gelling material according to the invention and agitating the entire system. The agitation may be done to such an extent as to effect mixing of the system lightly. And circulating by continuous pouring of the fluid done is sufficient as agitation. To increase the efficiency of agitation, a general-purpose agitator may be used, although this is by no means limitative. Further, the gelling material according to the invention may be set in the disposable container before introducing the body fluid thereinto.

The invention will now be illustrated with reference to the following examples that by no means limit the scope of the invention.

#### Example 1

A bag was produced by heat sealing along three edges of two overlapped oblong pieces 10 cm x 9 cm in size cut from "Dissolvo WAL" manufactured by Mishima Paper Mfg. Co., Ltd. This bag was then filled with 20 g of "SANWET IM-1000" (absorbing capacity : 1000 ml/g), an acrylic acid starch graft copolymer water-absorbing resin manufactured by Sanyo Chemical Industries, Ltd., and then its opening was heat sealed, thus obtaining a gelling material for aqueous fluids according to the invention.

This gelling material was added as such to 1.5 liters of sludge extracted from the sea bottom, and the resultant system was lightly agitated with a wooden spatula having a length of 20 cm and a width of 3 cm. The bag of the gelling material was disintegrated in about 10 secondes, and the overall system was gelled (i.e., solidified) in about 40 seconds. In this way, the sludge which was handled only with difficulty could be converted to solid readily capable of handling in a short period of time and conveniently.

#### Example 2

A bag was produced by heat sealing along three edges of two overlapped oblong pieces 10 cm x 9 cm in size cut from "Dissolvo WA" manufactured by Mishima Paper Mfg. Co., Ltd. The bag was then filled with 20 g of "SANWET IM-5000" (absorbing capacity : 400 ml/g), a partially crosslinked sodium polyacrylate manufactured by Sanyo Chemical Industries, Ltd., and then its opening was heat sealed, thus obtaining a gelling material for aqueous fluids according to the invention.

This gelling material was added to 1.5 liters of sludge-like paper pulp waste fluid, and the whole system was agitated with a wooden spatula having a length of 20 cm and a width of 3 cm. The bag of the gelling material was disintegrated in about 5 secondes, and the system was gelled (i.e., solidified) in about 30 seconds. Thus, the sludge which was handled only with difficulty could be converted to solid which could be readily handled.

#### Example 3

A bag was produced by heat sealing along three edges of two overlapped oblong pieces 10 cm x 9 cm in size cut from a commercially available polyvinyl alcohol (poval) film. The bag was then filled with 20 g of partially crosslinked sodium acrylate-acrylamide copolymer (absorbing capacity : 250 ml/g), and then its opening was heat sealed to obtain a gelling material for aqueous fluids according to the invention.

This gelling material was added to 1.5 liters of raw sewage sludge, and the whole system was

5 lightly agitated with a wooden spatula having a length of 20 cm and a width of 3 cm. The bag of the gelling material was disintegrated in about 40 secondes, and the system was gelled (i.e., solidified) in about one minute. Thus, the sludge which was handled only with difficulty could be converted to solid which could be readily handled.

#### Example 4

10 A bag was produced by heat sealing along three edges of two overlapped oblong pieces 10 cm x 9 cm cut in size from "Dissolvo WAL" manufactured by Mishima Paper Mfg. Co., Ltd. The bag was filled with "SANWET IM-1000" (absorbing capacity : 1000 ml/g), an acrylic acid starch graft copolymer water-absorbing resin manufactured by Sanyo Chemical Industries, Ltd., and its opening was heat sealed to obtain a gelling material for medical wastes according to the invention. In a 2-liter polyvinyl chloride container was extracted 1.5 liter of waste blood discharged during celiotomy, then the above gelling material was added as such, and the whole system was lightly agitated with a wooden spatula having a length of 20 cm and a width of 3 cm. The bag of the gelling material was disintegrated in about 10 secondes, and the system was gelled in about 50 seconds. Thus, blood in the form of fluid could be converted to solid, which could be readily handled, in a short period of time and conveniently.

#### Example 5

15 A bag was produced by heat sealing along three edges of two overlapped oblong pieces 10 cm x 9 cm in size cut from "Dissolvo WA" manufactured by Mishima Paper Mfg. Co., Ltd. The bag was then filled with 20 g of "SANWET IM-5000" (absorbing capacity : 400 ml/g), partially crosslinked sodium polyacrylate manufactured by Sanyo Chemical Industries, Ltd., and then its opening was heat sealed, thus obtaining gelling material for medical wastes according to the invention.

20 1.5 liter of waste blood produced during operation containing about 50 wt. % of physiological salt solution used for washing was collected into a 2-liter polyvinyl chloride container. Then, the above gelling material was added, and the system was lightly agitated with a wooden spatula having a length of 20 cm and a width of 3 cm. The bag of the gelling material was disintegrated in about 5 secondes, and the whole system was gelled in about 30 seconds. The blood in the form of fluid thus could be converted into solid capable of ready handling in a short period of time and conveniently.

#### Example 6

A bag was produced by heat sealing along three edges of two overlapped oblong pieces 10 cm × 9 cm in size cut from a commercially available water-soluble polyvinyl alcohol (poval) film. The bag was then filled with 20 g of partially crosslinked sodium acrylate-acrylamide copolymer (absorbing capacity : 250 ml/g), and then its opening was heat sealed, thus obtaining a gelling material for medical wastes according to the invention.

1.5 liters of waste blood produced during operation containing about 50 wt. % of physiological salt solution used for washing was collected into a 2-liter polyvinyl chloride container. The above gelling material was then added and the system was lightly agitated with a wooden spatula having a length of 20 cm and a width of 3 cm. The bag of the gelling material was disintegrated in about 50 secondes, and the whole system was gelled in about 80 seconds. Thus, body fluid in the form of fluid could be converted into solid capable of ready handling in a short period of time and conveniently.

#### Example 7

A bag was produced by heat sealing along three edges of two overlapped oblong pieces 10 cm × 9 cm in size cut from "Dissolvo WAL" manufactured by Mishima Paper Co., Ltd. The bag was then filled with 20 g of "SANWET IM-2200D" (absorbing capacity : 400 ml/g), an acrylic acid starch graft copolymer water-absorbing resin manufactured by Sanyo Chemical Industries, Ltd., and then its opening was heat sealed, thus obtaining a gelling material for medical wastes according to the invention.

3 liters of water was poured into a 5-liter vinyl chloride container containing medical wastes including a plurality of used syringes with needles, absorbent cotton, gauze and bandage containing blood, used ampoules and so forth. Then, the gelling material according to the invention produced as above was added, and the system was lightly agitated with a wooden spatula having a length of 20 cm and a width of 3 cm. The bag of the gelling material was disintegrated in about 10 secondes, and the system was gelled in about 45 seconds. Thus, the medical wastes could be converted into a gel (i.e., solid) in a short period of time and conveniently.

#### Example 8

A bag was produced by heat sealing along three edges of two overlapped oblong pieces 5 cm × 25 cm in size cut from "Dissolvo WAL" manufactured by Mishima Paper Industries, Ltd. with a pasting space of about 1 cm left. The bag was then filled with 40 g of "SANWET IM-2200D" (absorbing

capacity : 400 ml/g), an acrylic acid starch graft copolymer water-absorbing resin manufactured by Sanyo Chemical Industries, Ltd., and then its opening was heat sealed, thus obtaining a gelling material according to the invention for body fluids collected in body fluid suction equipment.

This gelling material was thrown into a liner (i.e. a disposable waste liquid container) provided in a canister fixing container of "Receptal", a medical suction system manufactured by Dainabot Ltd. Two liters of waste blood of the operated patient was collected by suction into the liner from an upper opening thereof in about 30 seconds. The bag of the gelling material was disintegrated in about 20 secondes, and the body fluid was gelled in about one minute from the start of its collection. Thus, body fluid in the form of fluid could be converted into solid in a very short period of time and conveniently.

#### Example 9

A bag was produced by heat sealing along three edges of two overlapped oblong pieces 5 cm × 25 cm in size cut from "Dissolvo WA" manufactured by Mishima Paper Mfg. Co., Ltd. with a pasting space of about 1 cm left. The bag was then filled with 40 g of "SANWET IM-5000" (absorbing capacity : 400 ml/g), partially crosslinked sodium polyacrylate manufactured by Sanyo Chemical Industries, Ltd., and then its opening was heat sealed, thus obtaining a gelling material for body fluid collected by body fluid suction equipment according to the invention.

This gelling material was thrown into a liner (i.e., a disposable waste liquid container) provided in a canister fixing container of "Receptal", a medical suction system manufactured by Dainabot Ltd. Then, 2 liters of waste blood of the operated patient was collected by suction in the liner from an upper opening thereof in 30 seconds. The bag of the gelling material was disintegrated in about 10 secondes, and the body fluid was gelled in about 45 seconds from the start of its collection. Thus, body fluid in the form of liquid could be converted into solid in a short period of time and conveniently.

#### Example 10

A bag was produced by heat sealing along three edges of two overlapped oblong pieces 5 cm × 25 cm in size cut from a commercially available water-soluble polyvinyl alcohol (Poval) film with a pasting space of about 1cm left. The bag was then filled with 40 g of partially crosslinked sodium acrylate-acrylamide copolymer (absorbing capacity : 250 ml/g), and its opening was heat sealed, thus

obtaining a gelling material for body fluid suction equipment according to the invention.

This gelling material was thrown into and set in a liner (i.e., disposable waste liquid container) provided in a canister fixing container of "Receptal", a medical suction system manufactured by Dainabot Ltd. Then, 2 liters of waste blood of the operated patient was collected by withdrawal in the liner from an upper opening thereof in 30 seconds. The bag of the gelling material was disintegrated in about 90 seconds, and the body fluid was gelled in about 3 minutes from the start of its collection. Thus, body fluid in the form of liquid could be converted to solid in a short period of time and conveniently.

The gelling material and gelling method of the invention can provide the following various merits.

(1) The absorbent and other components are wrapped in water-disintegrating paper and/or water-soluble film. Therefore, unlike the prior art gelling material, the gelling material according to the invention will never be spilled or dusted during handling.

Namely, the gelling material according to the invention, being a water-absorbent wrapped in bags etc. which disintegrate or dissolved when being wetted, can be made gel upon being put into the aqueous fluid such as body fluid etc. together with the bags. Thus, it is very convenient in use.

(2) Unlike the prior art, the gelling material does not require times for measuring and manually sprinkling for addition to the aqueous fluid. Thus, it can be handled without taking time and conveniently.

(3) It has high absorbing capacity, and therefore it may be used in small quantities.

(4) Even if external pressure is applied after absorption, the fluid content once absorbed is never released.

Since the gelling material and gelling method according to the invention has the above effects, they are useful for processing sludge-like waste fluid produced in civil and construction sites, paper pulp plants, fiber manufacturing and drying plants, chemical plants, electric and electronic product plants and food processing plants.

Recently, blood infection of disease viruses such as aids and B-type hepatitis are constituting social problems, and safe treatment of body fluids (such as blood, amniotic fluid and lymph fluid) produced during operation and parturition is demanded. A method is well known, for instance, where body fluid coming out during operation is recovered in a specified container with or without use of a section device and burned out for disposal. However, if the body fluid container is occasionally broken during transportation to the inciner-

ation site or body fluid is occasionally spilled by mistake, the body fluid can flow out and sink into the ground. In such case, it is difficult to recover the body fluid. If the gelling material and gelling method according to the invention is applied thereon, the liquified body fluid is solidified (by gelling), and flowing out of the liquid body fluid can be prevented even if the container is cracked. Also, if it is spilled out onto the ground, it can be easily gathered with a broom for preventing pollution and ensuring safety.

In addition, if liquid body fluid is charged into the incineration furnace, the temperature in the furnace is suddenly reduced. Therefore, the fluid has to be charged in small amounts by means of spraying. This means that large-scale charging equipment is necessary and that the furnace temperature control is difficult. According to the invention, the body fluid can be charged into the furnace after it has been gelled (i.e., solidified). By so doing, like the case of burning wet wood, the furnace temperature is not reduced suddenly, permitting ready burning.

With the above effects, the gelling material and gelling method according to the invention are useful for the treatment of medical wastes produced in hospitals, maternity hospitals, public health centers and other medical facilities.

And also, the gelling material and gelling method are particularly useful for body fluid suction equipment.

## Claims

1. A gelling material for gelling aqueous fluids, medical wastes or body fluids collected by body fluid suction equipment, comprising a water-absorbent which is wrapped in water-disintegrating paper or a water-soluble film or a laminated sheet which comprises water-disintegrating paper and water-soluble film, wherein said water-absorbent comprises a water-absorbing resin in the form of powders or granules.
2. The gelling material for gelling aqueous fluids according to claim 1, wherein said gelling material further contains a filler.
3. A method of gelling aqueous fluid comprising adding an aqueous fluid gelling material to aqueous fluid, wherein said aqueous fluid gelling material comprises a water-absorbent which is wrapped in water-disintegrating paper or a water-soluble film or a laminated sheet which comprises water-disintegrating paper and water-soluble film, and said water-absorbent comprises a water-absorbing resin in the

form of powders or granules.

4. The method of gelling aqueous fluid according to claim 3, wherein said gelling material further contains a filler. 5

5. A method of gelling medical wastes comprises adding a medical waste gelling material to a medical waste containing aqueous fluids, wherein said medical waste gelling material comprises a water-absorbent being wrapped in water-disintegrating paper or a water-soluble film or a laminated sheet which comprises water-disintegrating paper and water-soluble film, and said water-absorbent comprises a water-absorbing resin in the form of powders or granules. 10 15

6. The method of gelling medical wastes according to claim 5, wherein said gelling material further contains a filler. 20

7. A method of gelling fluid which flows into a disposable waste container set in a canister fixing container of body fluid suction equipment, comprises adding a body fluid suction equipment gelling material to said fluid, wherein said body fluid suction equipment gelling material comprises a water-absorbent being wrapped in water-disintegrating paper or a water-soluble film or a laminated sheet which comprises water-disintegrating paper and water-soluble film, and said water-absorbent comprises a water-absorbing resin in the form of powders or granules. 25 30 35

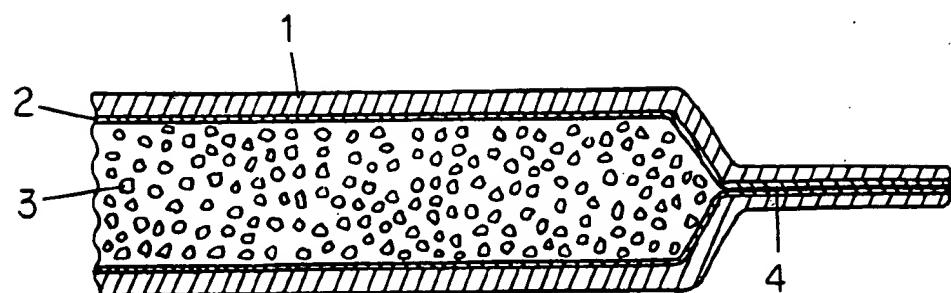
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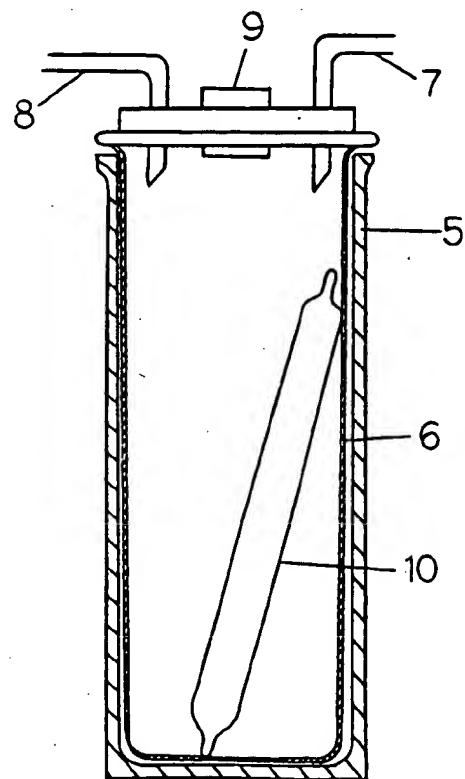
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F i g . 1



F i g . 2